

CLAIMES

1. An electronic device comprising:

a low dielectric constant film having a hole,

a nitrogen-non-containing insulating film formed under the low dielectric constant

5 film, and

a nitrogen-containing insulating film formed under the nitrogen-non-containing insulating film.

2. The electronic device of Claim 1, wherein

10 the hole passes through the nitrogen-non-containing insulating film and the nitrogen-containing insulating film,

the electronic device further includes a lower-level interconnect which is located under the hole and connected with the hole, and

15 the upper surface of the lower-level interconnect, except for a region in which the lower-level interconnect is connected with the hole, is covered with the nitrogen-containing insulating film.

3. The electronic device of Claim 1, wherein the lower surface of the low dielectric constant film is in contact with the upper surface of the nitrogen-non-containing insulating

20 film.

4. The electronic device of Claim 1, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

25 5. The electronic device of Claim 4, wherein the carbon-containing silicon oxide

film is a SiOC film.

6. An electronic device comprising:

a low dielectric constant film having a hole,

5 a nitrogen-non-containing insulating film formed over the low dielectric constant film, and

a nitrogen-containing insulating film formed over the nitrogen-non-containing insulating film.

10 7. The electronic device of Claim 6, wherein the nitrogen-containing insulating film is an anti-reflection film, and

a trench, which is connected with the hole, is formed in the nitrogen-containing insulating film, the nitrogen-non-containing insulating film, and at least an upper portion of the low dielectric constant film.

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8. The electronic device of Claim 6, wherein the upper surface of the low dielectric constant film is in contact with the lower surface of the nitrogen-non-containing insulating film.

20 9. The electronic device of Claim 6, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

10. The electronic device of Claim 9, wherein the carbon-containing silicon oxide film is a SiOC film.

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11. An electronic device comprising:

a low dielectric constant film having a hole,

a first nitrogen-non-containing insulating film formed under the low dielectric constant film, and

5 a second nitrogen-non-containing insulating film formed over the low dielectric constant film,

wherein the hole passes through the first nitrogen-non-containing insulating film, and

a trench, which is connected with the hole, is formed in the second nitrogen-non-
10 containing insulating film and at least an upper portion of the low dielectric constant film.

12. The electronic device of Claim 11, wherein the lower surface of the low dielectric constant film is in contact with the upper surface of the first nitrogen-non-containing insulating film.

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13. The electronic device of Claim 11, wherein the upper surface of the low dielectric constant film is in contact with the lower surface of the second nitrogen-non-containing insulating film.

20 14. The electronic device of Claim 11, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

15. The electronic device of Claim 14, wherein the carbon-containing silicon oxide film is a SiOC film.

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16. An electronic device comprising:

a low dielectric constant film having a hole, and

a low density insulating film having a film density of 1.3 g/cm^3 or lower and formed over the low dielectric constant film.

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17. The electronic device of Claim 16, wherein the low density insulating film contains nitrogen.

18. The electronic device of Claim 16, further comprising a nitrogen-containing
10 insulating film formed under the low dielectric constant film.

19. The electronic device of Claim 16, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

15 20. The electronic device of Claim 19, wherein the carbon-containing silicon oxide film is a SiOC film.

21. A method for fabricating an electronic device comprising:

the step of forming a nitrogen-non-containing insulating film and a low dielectric
20 constant film in sequence over a nitrogen-containing insulating film;

the step of forming a hole in the low dielectric constant film;

the step of applying a chemically amplified resist on the low dielectric constant film with the hole formed therein, and subjecting the chemically amplified resist to exposure and development processes, thereby forming a resist film having an opening in a
25 predetermined region that includes a region in which the hole is formed; and

the step of etching the low dielectric constant film with the resist film used as a mask, thereby forming a trench which is connected with the hole.

22. The method of Claim 21, wherein the nitrogen-containing insulating film is
5 formed so as to cover a lower-level interconnect.

23. The method of Claim 21, wherein the hole-forming step includes the step of forming the hole in the low dielectric constant film and the nitrogen-non-containing insulating film, and
10 the method further includes, after the trench-forming step, the step of removing part of the nitrogen-containing insulating film which is located under the hole.

24. The method of Claim 21, wherein the nitrogen-non-containing insulating film is deposited by a CVD process.
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25. The method of Claim 21, further comprising, between the hole-forming step and the resist-film forming step, the step of forming a dummy plug in the hole.

26. The method of Claim 21, wherein the low dielectric constant film is a carbon-
20 containing silicon oxide film or a porous film.

27. The method of Claim 26, wherein the carbon-containing silicon oxide film is a SiOC film.

25 28. A method for fabricating an electronic device comprising:

the step of forming a nitrogen-non-containing insulating film and a nitrogen-containing insulating film in sequence over a low dielectric constant film;

the step of forming a hole in the low dielectric constant film with the nitrogen-non-containing insulating film and the nitrogen-containing insulating film formed thereon;

5 the step of applying a chemically amplified resist over the low dielectric constant film with the hole formed therein, and subjecting the chemically amplified resist to exposure and development processes, thereby forming a resist film having an opening in a predetermined region that includes a region in which the hole is formed; and

10 the step of etching the low dielectric constant film with the resist film used as a mask, thereby forming a trench which is connected with the hole.

29. The method of Claim 28, wherein the nitrogen-containing insulating film functions as an anti-reflection film in the resist-film forming step.

15 30. The method of Claim 28, wherein the nitrogen-non-containing insulating film is deposited by a CVD process.

31. The method of Claim 28, further comprising, between the hole-forming step and the resist-film forming step, the step of forming a dummy plug in the hole.

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32. The method of Claim 28, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

33. The method of Claim 32, wherein the carbon-containing silicon oxide film is a
25 SiOC film.

34. A method for fabricating an electronic device comprising:

the step of forming a low dielectric constant film and a second nitrogen-non-containing insulating film in sequence over a first nitrogen-non-containing insulating film;

5 the step of forming a hole in the low dielectric constant film with the second nitrogen-non-containing insulating film formed thereon;

the step of applying a chemically amplified resist over the low dielectric constant film with the hole formed therein, and subjecting the chemically amplified resist to exposure and development processes, thereby forming a resist film having an opening in a
10 predetermined region that includes a region in which the hole is formed; and

the step of etching the low dielectric constant film with the resist film used as a mask, thereby forming a trench which is connected with the hole.

35. The method of Claim 34, wherein the first and second nitrogen-non-containing
15 insulating films are deposited by a CVD process.

36. The method of Claim 34, further comprising, between the hole-forming step and the resist-film forming step, the step of forming a dummy plug in the hole.

20 37. The method of Claim 34, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

38. The method of Claim 37, wherein the carbon-containing silicon oxide film is a SiOC film.

39. A method for fabricating an electronic device comprising:

the step of forming a low density insulating film whose film density is 1.3 g/cm^3 or lower on a low dielectric constant film;

the step of forming a hole in the low dielectric constant film with the low density
5 insulating film formed thereon;

the step of applying a chemically amplified resist over the low dielectric constant film with the hole formed therein, and subjecting the chemically amplified resist to exposure and development processes, thereby forming a resist film having an opening in a predetermined region that includes a region in which the hole is formed; and

10 the step of etching the low dielectric constant film with the resist film used as a mask, thereby forming a trench which is connected with the hole.

40. The method of Claim 39, further comprising, after the low-density-insulating-film forming step, the step of subjecting the low density insulating film to a heat treatment
15 or applying an energy wave to the low density insulating film.

41. The method of Claim 40, wherein the energy wave is an electron beam or ultraviolet radiation.

20 42. The method of Claim 39, wherein the low dielectric constant film is a carbon-containing silicon oxide film or a porous film.

43. The method of Claim 42, wherein the carbon-containing silicon oxide film is a SiOC film.